PATENT SPECIFICATION

NO DRAWINGS

Inventor: HENRI RICHAUD

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COMPLETE SPECIFICATION

Process for the Preparation of the Surface of Aluminium and its Alloys for Electroplating

We, PECHINEY COMPAGNIE DE PRODUITS CHIMIQUES ET ELECTROMETALLURGIQUES, a body corporate organised and existing under the laws of France, of 23, rue Balzac, Paris 8e, France, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns a process for the preparation of the surface of aluminium or its alloys before it is coated with a layer of metal by electrolysis.

More particularly it concerns a new bath composition having fluoborates as a base for treating the surface of aluminium or an alloy thereof before it is electroplated so that an adherent coating which is resistant to heat, thermal shocks and corrosion is obtained.

Before aluminium or one of its alloys is electroplated a special surface treatment is necessary, in addition to conventional cleaning operations, if the deposit is to be perfectly adherent. Zinc plating in an alkaline bath is currently used. This method, however, is only satisfactory if the coated object does not have to undergo heating, as the coatings thus provided have a rather low degree of resistance to heat and thermal shocks. Heating to above 120° causes the formation of blisters and a reduction in resistance to corrosion.

Another process comprises treating the surface of the aluminium with an aqueous solution of zinc and nickel fluoborates. A thin layer of zinc and nickel forms on the surface of the aluminium and brilliant and adherent coatings having a high degree of resistance to heat and corrosion can then be obtained by electronlating. However, this technique only gives good results on non-alloyed aluminium; when it is applied to aluminium alloys, the adherence of the coating is much diminished.

In accordance with the present invention aqueous solutions, for treating the surface of aluminium or an alloy thereof before electroplating, contain from 5 to 100 g./l. of zinc fluoborate, from 5 to 100 g./l. of nickel fluoborate and from 0.1 to 50 g./l. of magnesium ions, the pH of the solution being from 2 to 6.

Preferably the solution contains from 10 to 30 g./l. of zinc fluoborate, from 10 to 30 g./l. of nickel fluoborate and from 0.5 to 5 g./l. of magnesium ions. The pH of the solution is preferably from 3.5 to 4.5.

It is preferable to introduce the magnesium ions in the form of an oxide or hydroxide or a salt which is soluble in an acidic medium and, if necessary, to adjust the pH by adding fluoboric acid.

This solution is characterised with respect to the prior art, by the presence of a magnesium salt which is formed when magnesium oxide, magnesium hydroxide or a magnesium salt soluble in an acidic medium is added to the aqueous solution of zinc and nickel fluoborates. Magnesium carbonate or sulphate for example, may be used. Generally the pH value of the aqueous solution of the salts lies directly within the desired limits; if not, the quantity of fluoboric acid required to adjust the pH value of the bath is added.

Also in accordance with the present invention the surface of aluminium or aluminium alloy parts is prepared for electroplating by immersing the parts, which have been previously degreased by any known method, in an aqueous solution in accordance with the

invention at a temperature of from 10 to 80° for a period of from 5 seconds to 5 minutes depending on the temperature used.

All temperatures given in this specification are in °C.

Preferably the part is immersed for from 30 to 60 seconds and the temperature of the solution from 20 to 35°. After rinsing in water, the parts are ready to receive the electrolytic deposit of the desired metal e.g. copper, nickel, cadmium, chromium or silver.

The adherence may be improved by repeating the treatment. After the first immersion and subsequent rinsing, the surface deposit of zinc and nickel is dissolved in a solution of nitric acid, then, after rinsing in water, a second immersion in the bath according to the invention is effected and, finally, the part is rinsed in water before electroplating.

The fluoborate bath containing magnesium has great advantages over the alkaline zinc-plating bath even in cases where the parts to be treated do not have to be heated. It is much more fluid, and therefore losses due to the solution sticking to the parts are reduced and rinsing is easier. As it is slightly acid, it is less inclined to react with aluminium than the alkaline solutions are and therefore can be used in the treatment of slightly porous foundry parts for which the alkaline bath may not be used.

The following Examples illustrate the invention

EXAMPLE 1:

Chrome-plating of chilled cast parts of A G4 Z

This alloy contains 4% of magnesium and 1.2% of zinc. The parts are degreased first in trichloroethylene and then at 20° to 25° in an electrolytic bath containing 100 grams of trisodium phosphate, 20 grams of sodium carbonate and 5 grams of sodium silicate per litre. Electrolysis lasts for 2 minutes, at 12 volts, the part serving as the cathode. Afterwards the part is rinsed, cleaned in a sulphochromic bath at 60° and again rinsed in water. The bath for treating the surface before electroplating is an aqueous solution which contains:

zinc fluoborate corresponding to 20 g./l. of zinc
nickel fluoborate corresponding to 21 g./l. of nickel

and in which there are dissolved 3.5 g./l. of magnesium carbonate.

The pH of this solution is 4.1.

The part is immersed for 30 seconds in this bath at 30° and then rinsed in water. It is subsequently subjected to a brilliant nickel-plating, in a conventional acid bath, with a current density of 6 A/dm², at 55° to 60°, for 25 minutes, followed by chrome-plating in a conventional sulphochromic bath for 2 minutes at 50° to 55°. The part is then rinsed and dried.

The chrome-plate produced is very adherent: it resists, without forming blisters, one hour of heating at 200°, followed by rapid cooling by immersion in cold water. It also has a high degree of resistance to corrosion, since it suffers no deterioration by being exposed to standardised saline mist for 200 hours at 35°.

EXAMPLE 2:

Cadmium-plating of sheet parts of A U4 G.

This alloy contains 4% of copper, 0.7% of magnesium, 0.5% of silicon and 0.5% of manganese.

The sheet is degreased in trichloroethylene and then immersed for five minutes in a bath at 80° containing 10 g./l. of trisodium phosphate and 10 g./l. of sodium carbonate. After rinsing, the part is cleaned for five minutes at 25°, in an acid bath containing:

Nitric acid at 40° Baume	300 cm³
Water	700 cm³
Sodium fluoride	10 g./l.

The part is subsequently rinsed, then immersed for 45 seconds at 25° in a bath containing in aqueous solution:

zinc fluoborate corresponding to 14 g./l. of Zn and
Nickel fluoborate corresponding to 16 g./l. of Ni

to which 3 g./l. of magnesium sulphate is added; the pH is 3.8.

After rinsing, two successive deposits are effected, first of copper, and then of cadmium, in conventional cyanide baths having a strongly alkaline pH value using a current density of I A/dm², for four minutes at 45° for the copper-plating, and for 25 minutes at 20° for the cadmium-plating. Finally, the sheet is immersed for 5 seconds at ordinary temperature in a chromium-plating bath which contains: 80 grams of sodium bichromate, 8 grams of sulfuric acid at 66° Baume and 1 gram of sodium chloride.

The cadmium deposit thus obtained is very adherent and can withstand heating to 200° for 1 hour followed by rapid cooling in water without blistering. It shows no corrosion after being exposed to standardised saline mist for 200 hours at 35°.

EXAMPLE 3:

Silver-plating of spun parts of A G3.

This alloy contains 3% of magnesium and 0.4% of manganese. The parts are degreased in a solvent and then in an alkaline bath under conditions identical to those described in Example 2. The parts are then cleaned in a sulphochromic mixture at 55° to 60° for five minutes and rinsed. The sur-

face preparation is then effected in a bath comprising:

zinc fluoborate corresponding to 20 g./l. of zinc and

nickel fluoborate corresponding to 21 g./l. of nickel,

to which 3.5 g./l. of magnesium carbonate is added.

The pH of this bath is 4.1 and its temperature is fixed at 30°.

The operation is two-fold. The first immersion is carried out for 30 seconds and the part is rinsed. The surface deposit is then dissolved in nitric acid at 36° baume. After rinsing the part is again immersed in the fluoborate bath for 45 seconds. After washing the part is ready for silver-plating.

Preliminary silver-plating is first effected at 25° in a bath containing 5 g./l. of silver cyanide and 60 g./l. of sodium cyanide, using 2 A/dm², for 15 seconds. The final silver-plating is effected immediately afterwards at 25° in a bath containing 30 g./l. of silver cyanide, 55 g./l. of potassium cyanide and 45 g./l. of potassium carbonate, using 0.5 A/dm² for 90 minutes. The thickness of the silver layer is 25 microns. The part is finally rinsed and then dried in the air.

The silver deposit thus provided is very adherent and can withstand heating for 1 hour at 200° followed by rapid cooling by immersion in water without blistering. It shows no corrosion after being exposed to standardised saline mist for 200 hours at a temperature of 35°.

WHAT WE CLAIM IS:—

1. An aqueous solution for treating the surface of aluminium or an alloy thereof before electroplating, containing from 5 to 100 g./l. of zinc fluoborate, from 5 to 100 g./l. of nickel fluoborate and from 0.1 to 50 g./l. of magnesium ions the pH of the solution being from 2 to 6.

2. An aqueous solution as claimed in claim 1 containing from 10 to 30 g./l. of zinc fluoborate, from 10 to 30 g./l. of nickel fluoborate and from 0.5 to 5 g./l. of magnesium ions.

3. An aqueous solution as claimed in claim 1 or 2 in which the pH is from 3.5 to 4.5.

4. An aqueous solution as claimed in any one of claims 1—3 in which the magnesium ions are introduced in the form of an oxide or hydroxide or a salt which is soluble in an acidic medium and, if necessary, the pH is adjusted by adding fluoboric acid.

5. A process for the preparation of the surface of aluminium or aluminium alloy parts for electroplating which comprises immersing the parts, which have been previously degreased by any known method, in an aqueous solution as claimed in any one of claims 1—4 at a temperature of from 10 to 80° for a period of from 5 seconds to 5 minutes depending on the temperature used.

6. A process as claimed in claim 5 in which the part is immersed for from 30 to 60 seconds and the temperature of the solution is from 20 to 35°.

7. A process as claimed in claim 5 or 6 in which the immersion in the aqueous solution is repeated after the part has been rinsed, the deposit of zinc and nickel has been dissolved in nitric acid and the part has been rinsed again.

8. A process as claimed in claim 5 substantially as hereinbefore described in any one of the Examples.

9. Aluminium or aluminium alloy parts when prepared for electroplating by a process as claimed in any one of claims 5—8.

D. YOUNG & CO.,
8, Staple Inn,
London, W.C.1.,
Agents for the Applicant.

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